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BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte KEVIN GEORGE HARDING

Appeal 2007-3731
Application 10/065,882
Technology Center 2600

Decided: March 25, 2008

Before JOSEPH F. RUGGIERO, JOHN A. JEFFERY,
and KEVIN F. TURNER, *Administrative Patent Judges*.

JEFFERY, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellant appeals under 35 U.S.C. § 134 from the Examiner's rejection of claims 5, 6, 11, 12, 19, and 21. Claim 15 has been indicated as containing allowable subject matter (Ans. 3). We have jurisdiction under 35 U.S.C. § 6(b). We reverse.

STATEMENT OF THE CASE

Appellant invented a multi-layer holographic memory device. Specifically, plural holographic recording media are positioned in a stacked arrangement with plural memory address access media alternately interleaved therebetween. A readout method uses an interference effect between two optical beams directed at the multi-layer device to select out specific vertical memory locations without the recording media layers.[1]

Claim 5 is illustrative:

> 5. A method of reading a set of data stored in a memory device, the method comprising:
>
> causing a first optical beam to interfere with a second optical beam at a prescribed angle therebetween at a first selected hologram containing at least a segment of the set of data and having a discrete location and a corresponding address in the memory device, generating thereby an N^{th} diffraction order wavefront;
>
> wherein the first and second optical beams are characterized by a wavelength, an optical path length and a state of polarization;
>
> sensing the N^{th} diffraction order wavefront diffracted from the hologram;
>
> correlating the Nth diffraction order wavefront with a correlation pattern which includes the set of data; where N is an integer;
>
> if a correlation peak occurs, deconvolving the N^{th} diffraction order wavefront and the correlation pattern;

[1] *See generally* Spec. ¶ 0003; Abstract.

reading the set of data corresponding to the selected hologram and contained in the deconvolved N^{th} diffraction order wavefront; and,

reading the set of data in the N^{th} diffraction order wavefront for a second selected hologram by changing the wavelength of one optical beam with respect to the other.

Claims 5, 6, 11, 12, 19, and 21 stand rejected under 35 U.S.C. § 112, ¶ 1 as failing to comply with the enablement requirement.

Rather than repeat the arguments of Appellant or the Examiner, we refer to the Brief[2] and the Answer for their respective details. In this decision, we have considered only those arguments actually made by Appellant. Arguments which Appellant could have made but did not make in the Brief have not been considered and are deemed to be waived. *See* 37 C.F.R. § 41.37(c)(1)(vii).

OPINION

Regarding claims 5 and 11, the Examiner contends that the subject matter of the final recited limitation in the claims which calls for "reading the set of data in the N^{th} diffraction order wavefront for a second selected hologram by changing the wavelength of one optical beam with respect to the other" fails to comply with the enablement requirement. Citing

[2] We note in passing that the specific page and line number references to various recited limitations in the "Summary of Claimed Subject Matter" of the Brief (App. Br. 3-7) do not exactly correspond to the associated description in the Specification as the Examiner indicates (Ans. 2-3). Nevertheless, we consider this error harmless as it is not dispositive regarding our decision regarding the enablement rejection.

paragraph 27 of the disclosure, the Examiner asserts that the memory access media is "crucial" to select the second selected hologram as claimed. The Examiner, however, concludes that this media is not further described in the Specification to enable ordinarily skilled artisans to make and/or use the invention without undue experimentation (Ans. 4-5).

The Examiner takes a similar position with respect to (1) the last limitations of claims 6 and 12 (calling for, in pertinent part, reading the set of data for a second selected hologram by changing the state of polarization of one optical beam with respect to the other), and (2) the limitations of claims 19 and 21 which call for, in pertinent part, means for creating an interference pattern between two crossed polarized beams of light at a selected one of the discrete memory locations by rotating at least one of the beams of light (Ans. 5-6).

Appellant argues that none of the claims on appeal recite "memory access media," and such media is therefore not required to enable the claimed invention. In any event, Appellant contends, the disclosure expressly states that (1) the memory access media layer 106 can be eliminated (Spec. ¶ 0017), and (2) alternate approaches in lieu of using such media layers to create interference patterns can be used including matching the angular and wave shape content of the reference beam of the holographic recording (Spec. ¶ 0023) (App. Br. 9-10).

The Examiner, however, responds that these specific passages cited by Appellant do not pertain to the disputed limitations of the claims on appeal. According to the Examiner, the relevant disclosure pertaining to

these limitations is confined to paragraph 0027 which is said to require the memory access media (Ans. 7-8).

Although Appellant takes the position that memory access media is not required to enable the claimed invention as noted above, Appellant contends that, in any event, the memory access media is nonetheless adequately described in the Specification to enable ordinarily skilled artisans to make and/or use the invention without undue experimentation. In this regard, Appellant refers to, among other things, paragraphs 0027 and 0017, as well as Figures 1 through 3, 6, and 10. Appellant also notes that materials in layer form for controlling polarization are known in the art as evidenced by the exemplary patents in the Evidence Appendix (App. Br. 10-12; Ev. App.).

The Examiner acknowledges that while materials that control polarization may be known, it is unclear whether these materials have the specific properties necessary to enable the invention. The Examiner adds that the cited references do not demonstrate these properties (Ans. 8-13).

The issues before us, then, are (1) whether the claimed invention is enabled without memory access media, and (2) if not, whether such memory access media is sufficiently described in the Specification to enable ordinarily skilled artisans to make and/or use the claimed invention without undue experimentation. For the following reasons, we answer the first question "no," but we answer the second question "yes."

"The test of enablement is whether one reasonably skilled in the art could make or use the invention from the disclosures in the patent coupled

with information known in the art without undue experimentation." *United States v. Telectronics, Inc.*, 857 F.2d 778, 785 (Fed. Cir. 1988).

At the outset, we note that in the embodiment shown in Figure 1 of the present application, accessing a specific memory address of a chosen hologram involves causing two optical beams have slightly different wavelengths to interfere at an appropriate sector address. If the depth of the interference layer is sufficiently small compared to the thickness of each layer of holographic recording media 114, then *the memory address access media layer can be eliminated* (Spec. ¶ 0017; emphasis added; Figs. 1, 4, and 5).

The Specification further notes that, in one implementation, the memory access media 106 causes a phase shift in the optical beams 110, 112 to *cause an interference pattern to be created* at the corresponding hologram 114 and the data contained therein to be read out. According to the Specification, "[o]nce the beams 110, 112 have passed through the selected holographic recording media layer 104, they revert to their original non-interfering state by the next access media layer 106, *or otherwise no longer exhibit the spatial interference pattern* and so do not read any subsequent holograms at different layers" (Spec. ¶ 0023; emphasis added). Significantly, the Specification emphasizes that (1) other means for creating an interference pattern could be substituted, and (2) alternate approaches causing the holographic recording to be read out may include matching the angular and wave shape content of the reference beam of the holographic recording (*Id.*).

The clear import of this discussion is that while the memory access media layers do, in fact, cause an interference pattern to be created at a specified hologram, they are by no means necessary to create such a pattern. The Specification makes clear that other means to create the interference pattern could be used – the implementation of which, in our view, would be well within the level of ordinarily skilled artisans without undue experimentation.

That said, we cannot draw the same conclusion regarding the alternate embodiment of Figure 2. While Figure 2 appears strikingly similar to Figure 1 structurally, the functionality of the embodiment of Figure 2 differs from that of Figure 1 in a significant respect, namely that the memory address access media 206 comprise materials which cause polarization retardation of an optical beam at a particular wavelength. That is, the functionality of the memory access media 106 of the Figure 1 embodiment appears to be limited to causing a phase shift in the optical beams to form an interference pattern with the optical beams *at slightly different or the same wavelengths*. *See* Spec. ¶¶ 0017-19; Fig. 1.

In contrast, the primary function of the memory address access media 206 of the embodiment of Figure 2 is to affect the optical beams' *polarization retardation or rotation when the wavelength of the optical beams is changed*. By shifting the polarization of the beams in this manner, the memory address access media 206 in this embodiment ensure that the beams are not cross-polarized, thus allowing an interference pattern to form

at an appropriate hologram.[3] Thus, depending on the specific choice of wavelength, different memory address media layers will affect the beams' polarization retardation (and therefore location of the interference pattern) as noted above (Spec. ¶ 0025-27; Fig. 2). Simply put, selecting a specific wavelength in this embodiment, in effect, selects a specific location of interference pattern (and corresponding hologram) based on the type and location of the memory address access media in the multi-layer structure.

To implement this embodiment, we can envision various reasonable alternatives available to ordinarily skilled artisans for changing the wavelength of the optical beams that would not require undue experimentation. Nevertheless, we agree with the Examiner (Ans. 8) that the memory access media would be required to implement the polarization change of at least the Figure 2 embodiment. There is nothing on this record to indicate that the alternate approaches noted in paragraphs 0017 and 0023 pertain specifically to the embodiment of Figure 2. Rather, these approaches appear to be limited to other embodiments (e.g., the Figure 1 embodiment).

Significantly, the discussion in paragraph 0017 pertains to the embodiment of Figure 1 and refers specifically to memory address access media layer *106* -- not 206 -- in connection with its possible elimination under certain circumstances. Likewise, the alternate approaches discussed in paragraph 0023 appear to pertain to the *preceding* methods discussed (e.g., the embodiment of Figure 1) and are not discussed in connection with the

[3] According to the Specification, cross-polarized beams do not interfere. Spec. ¶ 0027.

Figure 2 embodiment, the discussion of which begins at paragraph 0025 of the Specification.[4]

Based on the record before us, we therefore find that the memory address access media are required for at least the embodiment of Figure 2. While claims 5, 6, 11, 12 do not specifically recite memory address access media,[5] the disputed limitations of these claims call for reading the data for a second selected hologram by changing a beam's (1) wavelength (claims 5 and 11), and (2) polarization (claims 6 and 12). Moreover, claims 19 and 21 call for creating an interference pattern in cross-polarized light beams by rotating at least one beam. Based on the record before us, we find the functionality described in the Specification in connection with these claims

[4] Significantly, the Specification states that "[a]lthough *specific methods have been described*, it is understood that other means for creating an interference pattern at a particular location within the holographic recording media could be substituted to operate in a similar manner without departing from the scope of the invention. Alternate approaches causing the holographic recording to be read out may include matching the angular and wave shape content of the reference beam of the holographic recording.

As best understood from Figure 1 the holograms 114…may be constructed separate from the holographic memory device 100…." (Spec. ¶ 0023-24; emphasis added).

[5] We note, however, that claim 21 does recite that "the plurality of *recording access media*…cause a change in phase of the two beams of light with respect to one another generating thereby non-cross polarized beams of light." (emphasis added). While the claim recites "recording media," there is no antecedent basis for term "*the* recording *access* media" – access media which we presume is distinct from the "recording media" and corresponds to the memory address access media 206 disclosed in the Specification in connection with the embodiment of Figure 2.

most reasonably corresponds to the embodiment described in connection with Figure 2.

With that in mind, we must now determine whether this required memory address access media is sufficiently described in the Specification to enable ordinarily skilled artisans to make and/or use the invention without undue experimentation.

As the Examiner correctly points out in the thorough and cogent analysis on pages 9 and 10 of the Answer, the memory access media must have the property such that it affects the polarization of the optical beams to ensure that the beams *remain cross-polarized* until the beams reach the desired hologram. At this point, the memory access media must then shift the beams' polarization such that they are *no longer cross-polarized* at the desired hologram and therefore can produce an interference pattern at this location. *See* Spec. ¶ 0027.

Materials that control polarization are known in the art – a fact that the Examiner readily admits.[6] To be sure, the Specification is short on specifics apart from indicating generally that the memory address access media 206 comprises "materials which cause polarization retardation of an

[6] *See* Ans., at 9 ("*Materials which control polarization may be known*, but do these materials have the specific properties necessary to enable Applicant's invention?") (emphasis added); *see also* M. Montoya et al., *A Simple Method for Changing the State of Polarization from Elliptical Into Circular*, Rev. Mex. Fis. 51(5)(2005), at 1, *available at* http://www.ejournal.unam.mx/rmf/no515/RMF51511.pdf (last visited Mar. 19, 2008) (discussing various known methods to control the polarization of light).

optical beam of a particular wavelength" (Spec. ¶ 0027). And while selecting such known materials to achieve the desired polarization effects would require *some* experimentation on the part of ordinarily skilled artisans, a disclosure may nonetheless be enabling despite the need for experimentation. The test is whether such experimentation is *undue*. *In re Angstadt*, 537 F.2d 498, 504 (CCPA 1976) (emphasis added).

Determining whether any necessary experimentation is undue involves consideration of many relevant factors including, but not limited to: (1) the breadth of the claims; (2) the nature of the invention; (3) the state of the prior art; (4) the level of one of ordinary skill; (5) the level of predictability in the art; (6) the amount of direction provided by the inventor; (7) the existence of working examples; and (8) the quantity of experimentation needed to make or use the invention based on the content of the disclosure. *In re Wands*, 858 F.2d 731, 737 (Fed. Cir. 1988).

Although the Examiner has considered several of these factors in concluding that the disclosure is non-enabling (Ans. 12-13), we nevertheless conclude that the experimentation needed to choose the requisite materials for the memory address access media to achieve the recited functionality would not rise to the level of *undue* experimentation. We reach this conclusion mindful of the relatively high skill level in this highly-specialized art -- a technology area with high degree of predictability -- and the fact that controlling polarization with known materials at particular wavelengths is well known. Moreover, while the absence of any working examples in the present disclosure tends to favor the Examiner's position, such a factor is

hardly dispositive: it is merely one of many factors to be considered. *See* MPEP § 2164.02, Rev. 6, Sept. 2007 ("MPEP"); *see also In re Borkowski*, 422 F.2d 904, 908 (CCPA 1970). On balance, we find that the other factors noted above tend to favor enablement and thus outweigh this factor.

In our view, given the well-known techniques of selecting materials to control polarization, an electrical engineer with the requisite training and experience in this field could have reasonably selected the appropriate polarizing materials for the memory address access media for a given wavelength to affect the cross-polarization of the beams at a desired hologram as disclosed. While *some* experimentation would be required in this endeavor, we find that it would not be *undue* based on the record before us.

For the foregoing reasons, we conclude that the disclosure is enabled for the subject matter recited in claims 5, 6, 11, 12, 19, and 21 and therefore complies with 35 U.S.C. § 112, ¶ 1. Accordingly, we cannot sustain the Examiner's enablement rejection of those claims.

DECISION

We have not sustained the Examiner's rejection with respect to any of the claims on appeal. Therefore, the Examiner's decision rejecting claims 5, 6, 11, 12, 19, and 21 is reversed.

REVERSED

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